

Cyperus pseudovegetus

Marsh Flat Sedge

Cyperaceae



Cyperus pseudovegetus by Dwayne Estes, 2015

***Cyperus pseudovegetus* Rare Plant Profile**

New Jersey Department of Environmental Protection
State Parks, Forests & Historic Sites
State Forest Fire Service & Forestry
Office of Natural Lands Management
New Jersey Natural Heritage Program

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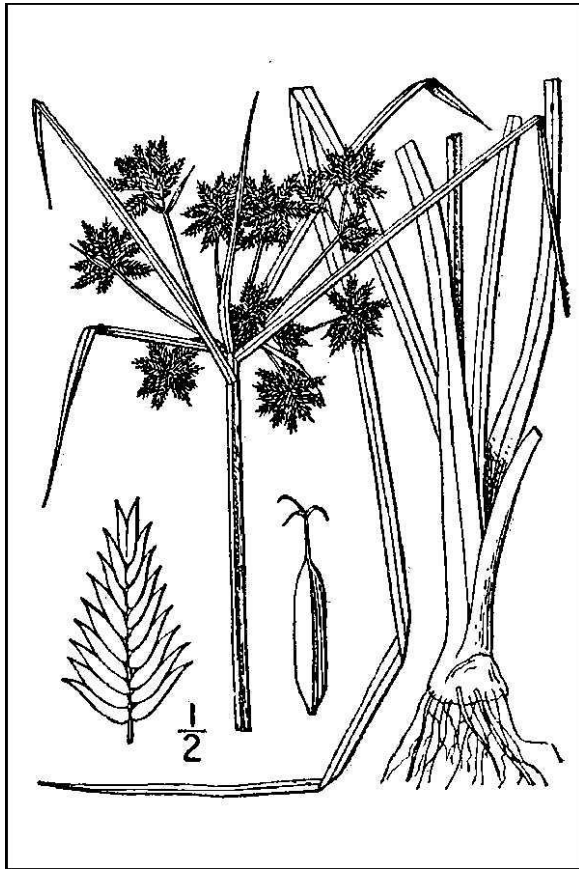
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Life History

Cyperus pseudovegetus (Marsh Flat Sedge) is a tufted perennial sedge that arises from a short, stiff rhizome. The culms are smooth, three-sided, and 30–65 cm in height. The leaves are usually about the same length as the culms or longer, V-shaped, and 4–6 mm wide. The terminal inflorescence has 3–6 rays that range from 1–30 mm in length and it is subtended by several bracts which are considerably longer. At the end of each ray is a dense, hemispheric head made up of 40–100 light green or tan spikelets. The spikelets are flattened and broadly ovate. Bryson and Carter (2012) reported an average spikelet length of 4 mm for *C. pseudovegetus*, but the structures can range between 3.5–5 mm in length and 3–4 mm in width. Each spikelet typically contains 12–16 floral scales and the individual scales are narrow and slightly curved (sickle-shaped), as are the achenes. (See Britton and Brown 1913, Fassett 1957, Mohlenbrock 1960, Denton 1978, Godfrey and Wooten 1981, Gleason and Cronquist 1991, Tucker et al. 2020, Weakley et al. 2022).



Left: Britton and Brown 1913, courtesy USDA NRCS 2023a. Right: Courtesy Peggy Romfh, Lady Bird Johnson Wildflower Center.

In New Jersey, *Cyperus pseudovegetus* begins flowering early in July and fruits may be present through October (Stone 1911, Hough 1983). The seeds require a period of dormancy (Justice 1957) so they are unlikely to germinate until the following spring. *C. pseudovegetus* seedlings are brown and have a very thin layer of translucent-iridescent cells. Iridescence has also been reported in the leaves and seedlings of some other sedges, but the structural mechanisms behind

the coloration have not yet been identified or described in the Cyperaceae (Gebeshuber and Lee 2015). A number of *Cyperus* species utilize the C₄ photosynthetic pathway but *C. pseudovegetus* is a C₃ species (Larridon et al. 2011).

Cyperus is a fairly large genus that has been divided into subgroups, and the placement of *C. pseudovegetus* in the Luzulae group is supported by numerous anatomical features (Denton 1978, 1983). Two other species in the Luzulae group can occasionally occur in New Jersey—*C. eragrostis* and *C. virens*—but both are nonindigenous and uncommon in the state (VanClef 2009, Kartesz 2015). Fernald (1950) did not distinguish between *Cyperus pseudovegetus* and *C. virens*, and Godfrey and Wooten (1981) acknowledged a strong similarity between the two species. *Cyperus virens* can be separated from *C. pseudovegetus* and *C. eragrostis* by its culms, which are notably rough on the angles, and by its leaves and bracts which are nodulose and have conspicuous cross-ribs between the veins. *Cyperus pseudovegetus* and *C. eragrostis* are best distinguished in fruit. The spikelets of the latter species are lanceolate to linear and often more than 5 mm long, and its achenes are not sickle-shaped (Weakley et al. 2022).

Pollinator Dynamics

Most species in the sedge family are pollinated by wind although there are a few notable exceptions in scattered genera, including *Cyperus* (Goetghebeur 1998). The *Cyperus* species that are pollinated by insects usually have showy bracts and produce slight floral odors, whereas those like *C. pseudovegetus* that are visually inconspicuous are wind-pollinated (Wragg and Johnson 2011).

In nearly all sedges the female flowers develop before the male flowers, which is thought to be a way of enhancing the opportunity for cross-fertilization (Goetghebeur 1998). However, the flowers of *Cyperus pseudovegetus* may be either bisexual or female and they do not occupy clearly defined positions within the spikelets (Guarise and Vegetti 2008). Although cross-pollination is presumed for the majority of sedges (Bryson and Carter 2008), some species of *Cyperus* are highly self-compatible (Merotto et al. 2007). No information was found regarding the potential for self-fertilization in *C. pseudovegetus*.

Seed Dispersal and Establishment

The achenes of *Cyperus pseudovegetus* are brown, linear, slightly curved, 1.2–1.4 mm long, and about 0.2 mm wide (Tucker et al 2020). Based on the average number of scales per spike, spikelets per inflorescence, and culms per plant Bryson and Carter (2012) calculated that a typical *C. pseudovegetus* plant would produce about 4,900 seeds.

A large proportion of *Cyperus pseudovegetus* seeds are likely to be dispersed by gravity, which is typical for the genus (Leck and Schütz 2005). Goetghebeur (1998) indicated that abundant seed production makes *Cyperus* species attractive to birds so they are likely to play a significant role in the dispersal of propagules over longer distances. Martin and Uhler (1939) reported that the seeds of various *Cyperus* species were consumed by waterfowl in small to moderate

quantities, and the seeds can also be used as a food source by an assortment of other birds including shore birds, game birds, and songbirds (Fassett 1957).

Seed bank studies have documented the presence of viable *Cyperus pseudovegetus* propagules in marshy and swampy habitats of tidal freshwater wetlands (Peterson and Baldwin 2004) and in other hardwood-dominated depression wetlands (Martin and Kirkman 2009). When some *C. pseudovegetus* seeds were maintained in dry storage their viability decreased slowly and they had a maximum lifespan of seven years (Justice 1957), but it is possible that the sedge's seeds could retain viability for a longer period in moist conditions.

Although fresh seeds of *Cyperus pseudovegetus* are initially dormant (Justice 1957), once dormancy has been broken they may be able to germinate at any time during the growing season when conditions are favorable. The strategy is typical of other mudflat species that require low water and high light levels in order to establish and occur in unpredictable habitats (Baskin et al. 1989). *C. pseudovegetus* fits the profile of a mud flat species according to experiments conducted by Middleton (2009), who found that the sedge germinated only in non-flooded treatments. Middleton also reported that *C. pseudovegetus* was more abundant in the seed banks of sites that were inundated for shorter periods during the course of a year.

Many species of *Cyperus* have been examined for the presence of mycorrhizae, although no direct references to *C. pseudovegetus* were found. Fungal associations have variously been reported as present or absent in different species within the genus, and roughly a quarter of the 38 *Cyperus* species listed by Wang and Qiu (2006) were identified as facultatively mycorrhizal. The mycorrhizal status of sedges is thought to be heavily influenced by environmental conditions, and while fungal associations are relatively infrequent in sites that are permanently inundated they are more likely to be established in places where the water levels fluctuate seasonally (Muthukumar et al. 2004).

Habitat

Cyperus pseudovegetus grows in damp, moist, or wet soils at elevations ranging from 0–200 meters above sea level. Natural habitats include open marshes, forested swamps, alluvial deposits, stream banks, pond or lake shores, sloughs, and swales (Williamson 1909, Mohlenbrock 1960, Godfrey and Wooten 1981, Hough 1983, Carter 2005, Tucker et al. 2020, Weakley et al. 2022). Szakacs et al. (2022) described *C. pseudovegetus* as a generalist species relative to light requirements/shade tolerance, although high light levels might be needed for new plants to establish (Baskin et al. 1989). The sedge can be unevenly distributed within a community: It is most likely to establish in low or flat areas but tends to be absent or rare on hummocks (Battaglia et al. 2002, Sleeper and Ficklin 2016).

In New Jersey, *Cyperus pseudovegetus* is associated with intermittent ponds on the coastal plain (Johnson and Walz 2013). Taylor (1915) reported that the original population in the state was situated close to sea level at a site where the growing season lasted for approximately 179 days. Other sites in New Jersey have been described as partially inundated or seasonally wet, and a number of habitats in the state were anthropogenic in origin including an excavated pit, a ditch,

and an abandoned roadway (NJNHP 2022). *Cyperus pseudovegetus* also frequents intermittently wet disturbed sites in other parts of its range, where it is relatively common in roadside ditches or abandoned fields and pastures (Banta 1935, Bryson and Carter 2008). In New York, where the species is considered adventive, the sedge was found in a low sandy area along the edge of a path (Lamont et al. 2014). Middleton (2003) noted that *C. pseudovegetus* was present in cypress swamps that developed on former agricultural sites but absent from undisturbed swamps. In Texas, Marsh Flat Sedge occurred in a prairie remnant that had been subjected to frequent mowing, haying, and burning for decades (Rosen 2007, 2010).

Spontaneous establishment of *Cyperus pseudovegetus* has been documented in abandoned farm fields (Battaglia et al. 2002), clearcut sites (Martin and Kirkman 2009), and restored wetlands (Sleeper and Ficklin 2016). Martin and Kirkman (2009) observed that *C. pseudovegetus* was one of the most common species in an herbaceous community that developed following the removal of hardwoods. Battaglia et al. (2002) reported that *C. pseudovegetus* appeared in fields five years after the cessation of farming and then persisted for at least a decade (through the end of the study). Sleeper and Ficklin (2016) noted that *C. pseudovegetus* was a dominant species in swales at a restored wetland twelve years after the completion of the project.

Wetland Indicator Status

Cyperus pseudovegetus is a facultative wetland species, meaning that it usually occurs in wetlands but may occur in nonwetlands (U. S. Army Corps of Engineers 2020).

USDA Plants Code (USDA, NRCS 2023b)

CYPS

Coefficient of Conservatism (Walz et al. 2018)

CoC = 4. Criteria for a value of 3 to 5: Native with an intermediate range of ecological tolerances and may typify a stable native community, but may also persist under some anthropogenic disturbance (Faber-Langendoen 2018).

Distribution and Range

The global range of *Cyperus pseudovegetus* is restricted to the United States (POWO 2023). The map in Figure 1 shows the known extent of the species. *C. pseudovegetus* is not considered indigenous in New York or Massachusetts so New Jersey marks the northernmost reach of its native range (Dow Cullina et al. 2011, Lamont et al. 2014, Tucker et al. 2020).

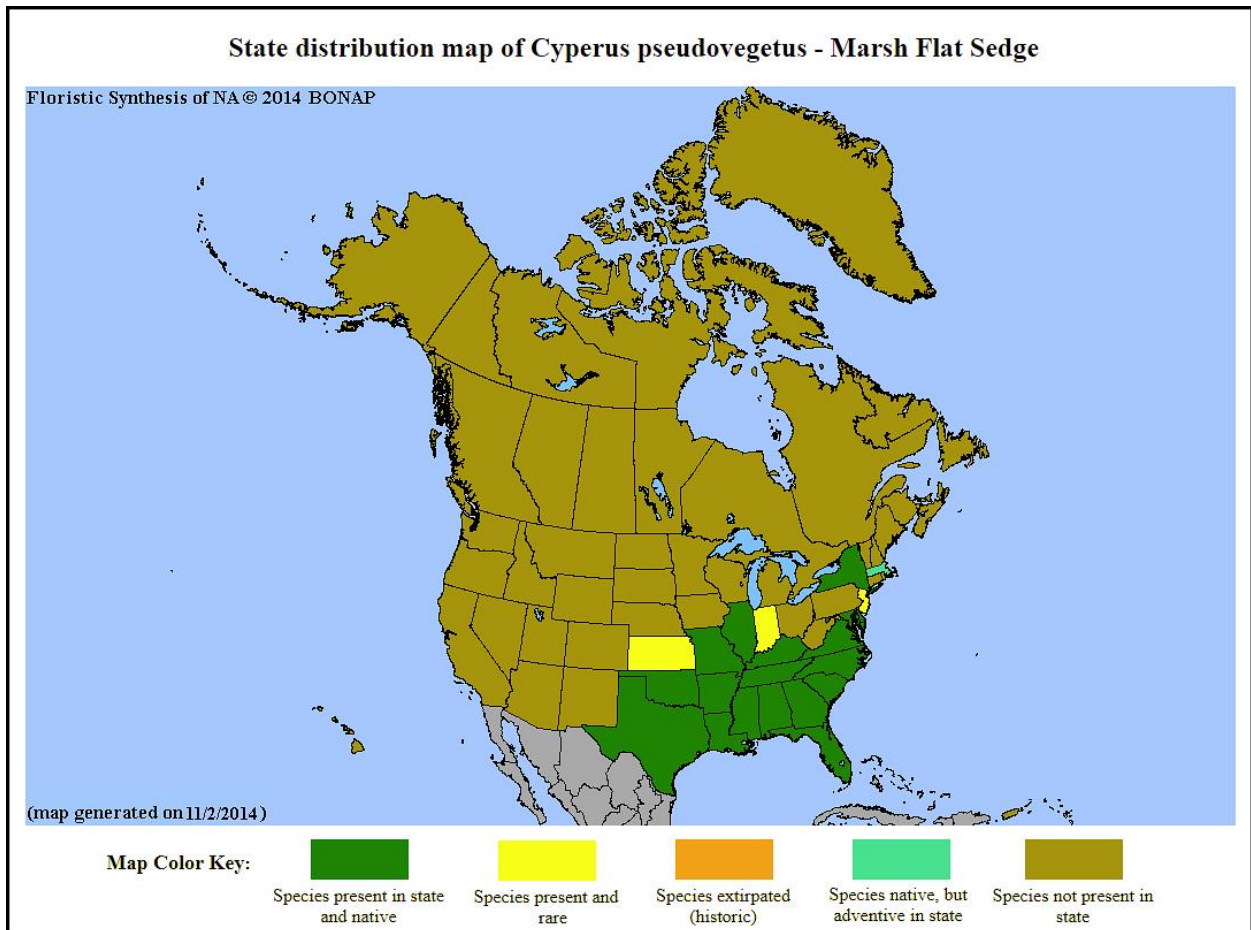


Figure 1. Distribution of *C. pseudovegetus* in North America, adapted from BONAP (Kartesz 2015).

The USDA PLANTS Database (2023b) shows records of *Cyperus pseudovegetus* in four New Jersey counties: Burlington, Cumberland, Ocean, and Salem (Figure 2, below). A specimen was also reported from Somerset County (Mid-Atlantic Herbaria 2023). The data include historic observations and might not reflect the current distribution of the species.

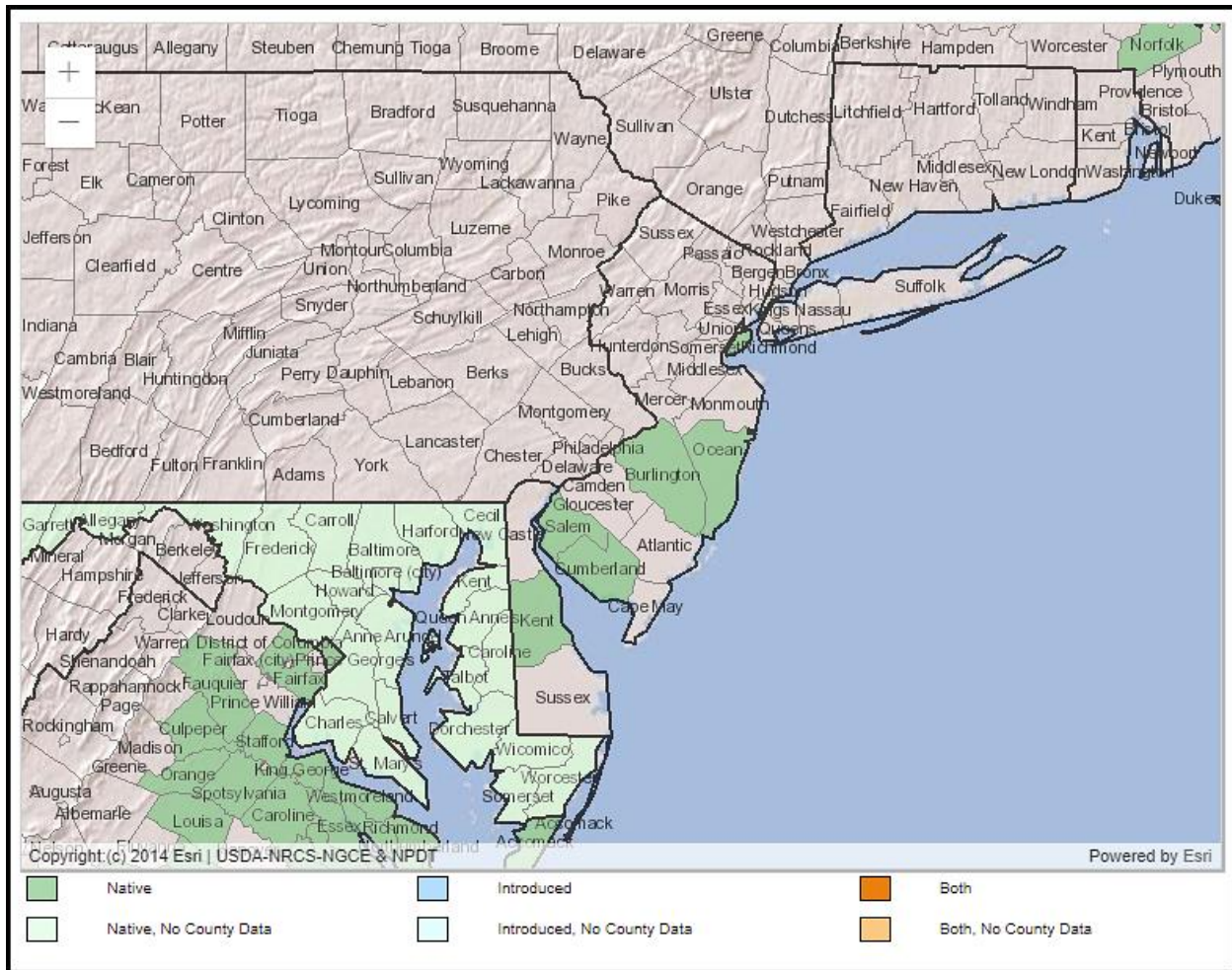


Figure 2. County records of *C. pseudovegetus* in New Jersey and vicinity (USDA NRCS 2023b).

Conservation Status

Cyperus pseudovegetus is considered globally secure. The G5 rank means the species has a very low risk of extinction or collapse due to a very extensive range, abundant populations or occurrences, and little to no concern from declines or threats (NatureServe 2023). The map below (Figure 3) illustrates the conservation status of *C. pseudovegetus* throughout its range. Marsh Flat Sedge is vulnerable (moderate risk of extinction) in two states, imperiled (high risk of extinction) in one state, and critically imperiled (very high risk of extinction) in one state. The sedge is most likely to face threats near the northern edge of its range. In the southern states *C. pseudovegetus* is secure or unranked, and sometimes it has even been viewed as a weedy species (Justice 1957, Bryson et al. 1989, WSSA 2023).

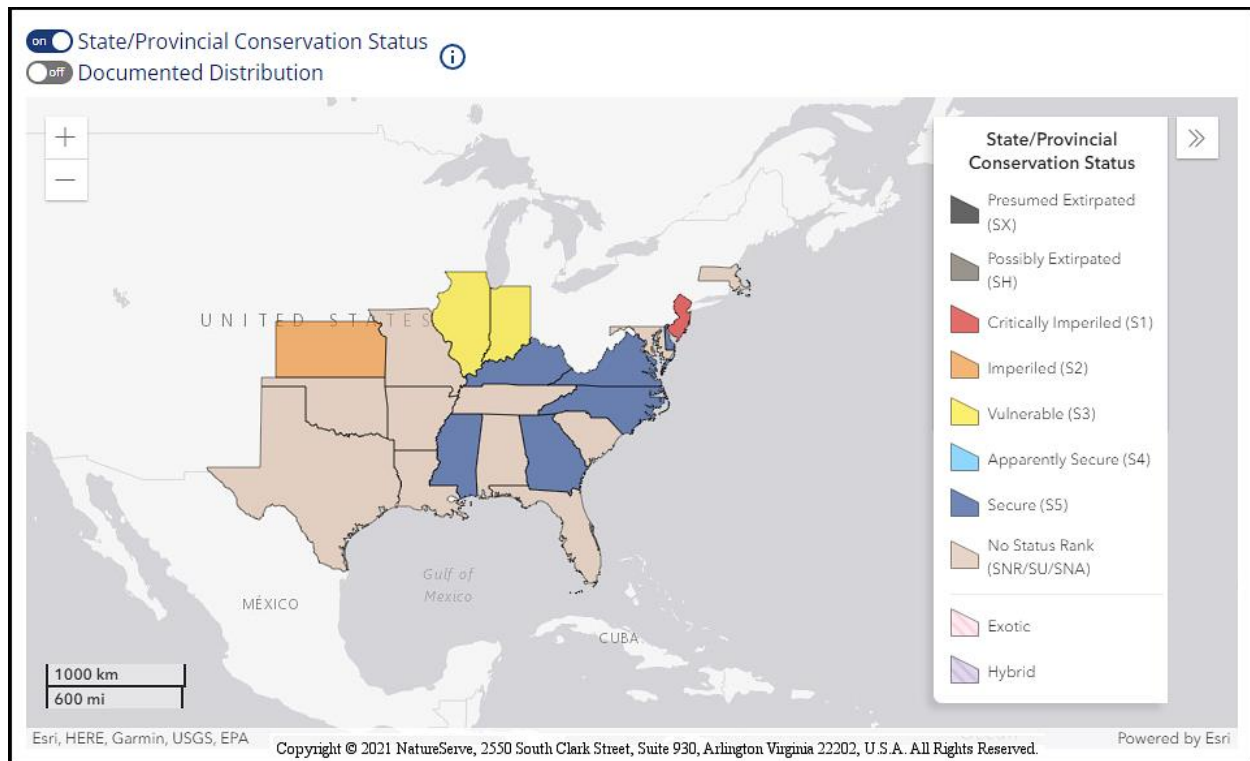


Figure 3. Conservation status of *C. pseudovegetus* in North America (NatureServe 2023).

New Jersey is the only state where *Cyperus pseudovegetus* is listed as critically imperiled (NJNHP 2022). The S1 rank signifies five or fewer occurrences in the state. A species with an S1 rank is typically either restricted to specialized habitats, geographically limited to a small area of the state, or significantly reduced in number from its previous status. *C. pseudovegetus* is also listed as an endangered species (E) in New Jersey, meaning that without intervention it has a high likelihood of extinction in the state. Although the presence of endangered flora may restrict development in certain communities such as wetlands or coastal habitats, being listed does not currently provide broad statewide protection for the plants. Additional regional status codes assigned to the sedge signify that the species is eligible for protection under the jurisdictions of the Highlands Preservation Area (HL) and the New Jersey Pinelands (LP) (NJNHP 2010).

Cyperus pseudovegetus was first discovered in New Jersey in 1894 (Stone 1911) and for a while its known extent in the state was limited to a single site (Taylor 1915). The sedge was observed in four south Jersey counties sometime between 1930–1980 (Hough 1983). Although the original population is now considered extirpated, recent records of the species have originated from the same four counties (one site per county). Three of those occurrences are still extant but the fourth was last seen in 1990 and is likely historical (NJNHP 2022).

Threats

New Jersey's extant populations of *Cyperus pseudovegetus* are all fairly small in size and a number of potential threats have been noted at the sites including foot traffic, impacts from

nearby agriculture, invasive species, and succession (NJNHP 2022). Exotic plants of concern included *Cyperus iria*, *Arthraxon hispidus*, and *Phragmites australis* ssp. *australis*, the latter being present at two sites. At another New Jersey location where succession was noted as a threat to the sedge in 1990 no *C. pseudovegetus* plants were found when subsequent surveys were conducted during 1995 and 2011. Although the species can apparently withstand shading (Szakacs et al. 2022), open space may be required for the establishment of new plants or belowground competition could be a factor in later successional habitats.

Cyperus pseudovegetus is perennial but the plants do not spread vegetatively (USDA NRCS 2023b) so seeds are necessary for the long-term maintenance of populations as well as for colonization of new sites. However, the species is susceptible to a fungus (*Balansia cyperi*) that interferes with its sexual reproduction. The infection halts inflorescence development—effectively sterilizing the host—and once a sedge has been colonized by *B. cyperi* the fungus remains present in the plant (Diehl 1950, Clay et al. 1985). *Balansia cyperi* may provide infected plants with some measure of protection against insect herbivory, (Clay et al. 1985) and some other *Cyperus* species that were affected by the fungus subsequently shifted to a greater investment in vegetative growth. *Cyperus virens* produced viviparous plantlets on the inflorescence in place of seeds, although the young plants were also infected with the fungus (Clay 1986), and *Cyperus rotundus* generated more numerous tubers (Stovall and Clay 1988). Changes in vegetative development were not reported for infected plants of *Cyperus pseudovegetus*, and any limited benefit from a reduction in leaf herbivory would not appear to compensate for the loss of reproductive capacity.

Community-wide threats reported for intermittent pond habitats like those favored by *Cyperus pseudovegetus* in New Jersey often stem from changes to hydrologic regime and/or water quality (Kirkman et al. 1999, Johnson and Walz 2013). Unlike many other plants that frequent intermittent coastal plain ponds, *Cyperus pseudovegetus* may be tolerant of some variation in water quality. The sedge was tested for potential use in contaminant uptake but its rate of element accumulation was not particularly high compared to other species examined (Qian et al. 1999). However, a shift in typical seasonal water levels could be more problematic: An evaluation by Ring et al. (2013) determined that *C. pseudovegetus* was moderately vulnerable to climate change in New Jersey primarily because of its hydrologic requirements. Changing precipitation patterns and rising temperatures are leading to more frequent and prolonged droughts in New Jersey, as well as unpredictable flooding events (Hill et al. 2020). Species like *C. pseudovegetus* that establish on moist soils during periods of drawdown could be thwarted by excessively arid conditions or untimely inundation.

On the other hand, *Cyperus pseudovegetus* might be able to expand its range northward as the climate becomes warmer. As previously noted, the sedge has been cited as a weedy species in the south and can take advantage of disturbance to establish new populations. Rosen (2007) described the regional climate associated with one southern population as "characterized by long hot summers and mild winters." All of the states where *C. pseudovegetus* is present but rare are situated along the northern edge of its range (see Figure 3), and if the species' distribution has previously been limited by short growing seasons or low temperatures it could become more abundant in some of those places.

Management Summary and Recommendations

At least a decade has elapsed since the last time New Jersey's three small populations of *Cyperus pseudovegetus* were observed (NJNHP 2022) and updated surveys are recommended at all sites. Monitoring visits can be used to note population size, plant vigor, evidence of reproduction, and impending threats. Suitable habitat in close proximity to extant occurrences should also be searched for additional colonies.

Research on various aspects of the life history and ecological relationships of *C. pseudovegetus* could shed some light on the species' distribution and capacity for adaptation to changing conditions. Suggested topics include the potential for/extent of self-fertilization, formation of mycorrhizae, and competitive abilities with both native and non-native plant species. More information is also needed regarding the effects of *Balansia cyperi* infections on individual *C. pseudovegetus* plants and on populations.

A number of new occurrences of Marsh Flat Sedge have been documented in New Jersey and New York during the past 15 years (Lamont et al. 2014, NJNHP 2022). A review of the species' global status could help to ascertain whether the sedge is expanding northward. Diehl (1950) indicated that *Balansia cyperi* reached the northern end of its range in Arkansas but its distribution could also shift with changing climactic conditions, and understanding the possible movements of both host and fungus could be important if *B. cyperi* is proven to have a significant impact on *Cyperus pseudovegetus*.

Synonyms

The accepted botanical name of the species is *Cyperus pseudovegetus* Steud. Orthographic variants, synonyms, and common names are listed below (ITIS 2023, POWO 2023, USDA NRCS 2023b).

Botanical Synonyms

Cyperus calcaratus S. Watson
Cyperus virens var. *arenicola* (Steud.) Shinners

Common Names

Marsh Flat Sedge
Marsh Umbrella Sedge
Knob Sedge

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